



U.S. Department of Energy
Oak Ridge Operations Office
Oak Ridge, Tennessee

Transporting DOE UF₆ Cylinders from Oak Ridge, TN to Portsmouth, OH

The Oak Ridge Gaseous Diffusion Plant was part of the nation's nuclear defense complex built in the city of Oak Ridge, TN. The facility processed large quantities of uranium by gaseous diffusion to produce enriched uranium in the form of uranium hexafluoride (UF₆). UF₆ can conveniently be used in the gas form for processing, in the liquid form for filling or emptying containers, and in the solid form for storage. "Depleted" UF₆ (DUF₆) is a product of the enrichment process and is stored at three uranium enrichment sites, located at Paducah, Kentucky; Portsmouth, Ohio; and the East Tennessee Technology Park (ETTP, formerly known as the K-25 site) in Oak Ridge, Tennessee. DOE has management responsibility for approximately 700,000 metric tons of DUF₆ contained in about 57,700 steel cylinders at the three sites. DOE has stored such material at these sites since the 1950s.

The eventual disposition of DUF₆ is of considerable interest to members of the U.S. Congress, concerned citizens, and other stakeholders. Public Law 105-204, signed by the President on July, 1998 requires DOE to build two conversion facilities, one each at Portsmouth, Ohio, and Paducah, Kentucky.



Depleted UF₆ Cylinder Storage Yard at Portsmouth, OH



Shipment Prepared for Highway

DEFINING URANIUM HEXAFLUORIDE

Uranium hexafluoride is a chemical compound consisting of one atom of uranium combined with six atoms of fluorine. It is the chemical form of uranium that is used during the uranium enrichment process. Within a reasonable range of temperature and pressure, it can be a solid, liquid, or gas. Solid UF₆ is a white, dense, crystalline material that resembles rock salt. UF₆ does not react with oxygen, nitrogen, carbon dioxide, or dry air, but it does react with water or water vapor.

UF₆ is always handled in leak tight containers and processing equipment. When UF₆ comes into contact with water, such as water vapor in the air, the UF₆ and water react, forming corrosive hydrogen fluoride (HF) and uranyl fluoride (UO₂F₂).

TRANSPORTATION PACKAGING

DUF₆ has been transported safely for more than 40 years. Specific requirements exist for the shipment of DUF₆ cylinders. Among other considerations, DUF₆ cylinders must be designed, fabricated, inspected, tested, and marked in accordance with the version of American National Standard N 14.1, "Uranium hexafluoride - Packaging for Transport" that was in effect at the time the cylinder was manufactured. Three requirements are particularly important relative to DUF₆ cylinder shipments: (1) cylinders must be filled to less than 62% of the certified volumetric capacity; (2) the pressure within cylinders must be less than 14.8 pounds per square inch; and (3) cylinders must be free of cracks, excessive distortion, bent or broken valves or plugs, and broken or torn stiffening rings or skirts, and must not have shell thicknesses that have

decreased below a specified minimum value. Cylinders meeting these requirements are often referred to as *compliant cylinders*.

Compliant cylinders will be transported via highway, using flatbed or low-boy trailers, with the cylinders affixed to the trailer via a specially designed adherence cradle. Initially, only one cylinder, with a maximum weight of 14 metric tons will be loaded per transport vehicle.

However, at a later date and depending on the cylinder size and weight, multiple cylinders will be transported.

IDENTIFYING SHIPMENT CONTENTS

"Radioactive, Class 7" and "Corrosive" placards will be placed on the front, back, and both sides of the tractor trailer in accordance with DOT placarding requirements. In addition, all DOT required emergency response information will be contained in the shipping papers and readily available for all law enforcement and emergency response personnel. These are located in a pocket located on the driver's door or within arm's length of the driver. DOE maintains a 24-hour emergency response phone number through its plant shift superintendent's (PSS) offices. All PSS personnel are trained in the communication and notification system network in the unlikely event of a transportation incident.

SHIPMENT ROUTING

The shipment route was accomplished through a series of negotiations with State emergency management, radiological health, and state police representatives from Tennessee, Kentucky, and Ohio.

The preferred and alternate routes were selected primarily upon quickest transit time, lower population centers, road conditions, and traffic flow patterns. Cylinders will not be in transport for more than 10 consecutive hours.

INSPECTIONS

ETTP contractors and the State of Tennessee, through random inspections, will perform radiological surveys and inspections prior to cylinder departure. Transport vehicles and cylinders will be available to State highway and radiological health inspectors during loading and prior to leaving ETTP, as well as upon arrival and during unloading at Portsmouth.

SHIPMENT TRACKING

The ETTP UF₆ cylinder shipments will be monitored 24 hours a day using the shipment monitoring capabilities of the DOE Transportation and Tracking Communications system (TRANSCOM), a satellite tracking/communication system.

NOTIFICATION OF STATE OFFICIALS

The DOE Oak Ridge Operations Office, within the Office of Site Closure, will inform affected States two weeks prior to initiation of the shipments. Included with the notification will be a description of cylinder(s) and contents; highway route; and appropriate shipping schedules. Real-time notification of daily shipments will be available through TRANSCOM.

EMERGENCY RESPONSE

In the unlikely event of an incident involving one of these shipments, State and local government agencies and the carrier would have the primary responsibility for response. DOE has provided radiological and emergency response training regarding these shipments to affected State and local emergency response units through its Transportation Emergency Preparedness Program (TEPP).

DOE has also coordinated key emergency response notification and response issues with the affected State emergency management agencies. DOE Radiological Assistance Program (RAP) teams are available at the Oak Ridge Operations Office in the event of an incident. RAP teams are deployed within an hour.

Highway carriers have established Emergency Response Plans and have contingency plans for cleanup and recovery, if needed. DOE-ORO and its contractor, Bechtel-Jacobs Company, LLC, have developed a Transportation Plan and will maintain a 24-hour emergency response telephone number to provide responders on-scene with comprehensive emergency response and incident mitigation information regarding the material in the shipment.

ADDITIONAL INFORMATION

Requests for additional information on the ETTP shipments should be referred to Steve Wyatt, DOE Public Affairs Officer at (865) 576-0888.

E-mail: wyattsl@oro.doe.gov

Information on DUF₆ and Emergency Response Training:

- Transportation Emergency Preparedness Program
Website: www.em.doe.gov/otem
- Depleted UF₆ Program Information Site
Website: <http://web.ead.anl.gov/uranium>
- DOE Headquarters, Freedom of Information Reading Room, 1000 Independence Avenue, SW, Room 1 E-190, Washington, DC 20585. Telephone: (202) 586-3142.
- Oak Ridge/DOE Information Center, DOE Public Reading Room, 475 Oak Ridge Turnpike, Oak Ridge, Tennessee 37830. Telephone: (865) 241-4780; 800-382-6938, option 6.
- Portsmouth/DOE, Environmental Information Center, 3930 U.S. Route 23, Perimeter Road, Piketon, Ohio 45661. Telephone: (740) 289-3317